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(54) **AUTOMATIC GATHERING AND ANALYSIS OF DATA ON COMMUTE PATHS**

5,835,026 A * 11/1998 Wicks et al. 340/905
5,850,190 A * 12/1998 Wicks et al. 340/905
6,466,862 B1 * 10/2002 DeKock et al. 701/117

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* cited by examiner

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(58) **Field of Search** 701/117, 118, 701/119, 202, 209, 210; 340/905, 988

(56) **References Cited**

U.S. PATENT DOCUMENTS

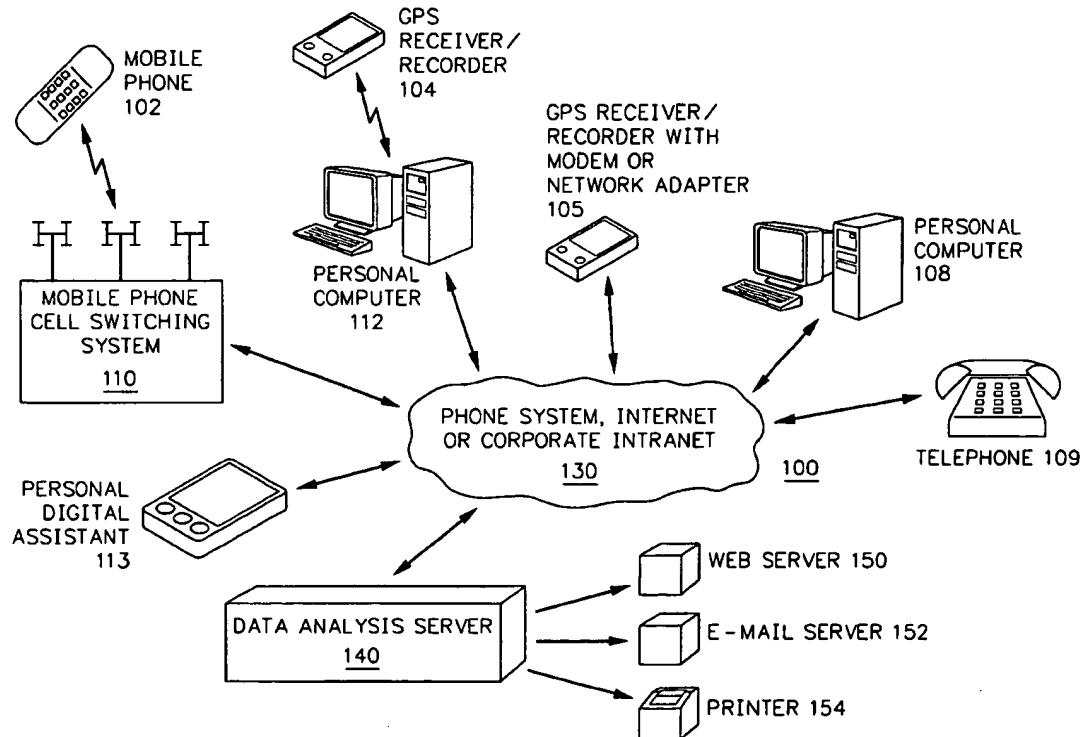
5,774,827 A * 6/1998 Smith, Jr. et al. 701/209

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(57) **ABSTRACT**

A method and apparatus for automatically gathering data on paths taken by a number of commuters and then analyzed to provide recommendations for improving the commute experience. Data may be gathered by recording time and position data from a global positioning system (GPS) receiver the commuter carries, recording time and position data from a mobile phone the commuter carries, departure or arrival indications, or a commute log. Commute data may be augmented with a likely route generated based on a start point, an end point, and a map. Commute data may be analyzed by determining a subset of the commuters whose paths are similar. For example, they have a similar start point, a similar end point, a similar start point and a similar end point, a start point similar to a particular point, an end point similar to a particular point, or similar start and end points.

33 Claims, 5 Drawing Sheets



municate with any transceiver on the network by locating the transceivers sufficiently close to each other.

Detailed Description Text - DETX (26) :

If a commuter is using their mobile phone as they commute, then the phone call is handed off from one transceiver to another at various points. This handoff process is controlled by mobile phone cell switching system 110 (FIG.

1). In the example path from start point 320 to end point 325, there are seven

handoff points 330. In some embodiments of the invention, mobile phone cell

switching system 110 records the date and time at which the mobile phone of

each enrolled commuter passes each handoff point.

Detailed Description Text - DETX (27) :

Given the handoff-point information and given map information of the roads

in the area, the data analysis server can infer the commuter's route with a

reasonable degree of accuracy. In some embodiments of the invention, this

analysis takes into account factors including, but not limited to, the fact

that the handoff points are not deterministic, and which roads are major ones

more likely to be used to get from start point 320 to end point 325. It should

be noted that map-based analysis, combined with the sort of "probable route"

generation" used by map servers, can be used to determine a "most plausible"

route to match a sequence of call handoffs.

Detailed Description Text - DETX (28) :

An example of non-determinism in handoff points 330 is shown between cell #4

and cell #5 in FIG. 3. The commuter's traj